Variation analysis of the top 100 high lead content lipstick brands

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ABSTRACT

The top 100 lead-filled lipsticks were analyzed using three variables of each lipstick: the lead content value (parts-per-million), type of lipstick and the reflective value of the lipstick's color. Cluster analyses were used to group and find the pattern of the lipsticks' lead content value (parts-per-million) to its type and reflective value. Results showed that matte-type of lipstick have higher lead content than the crème-type. The low reflective value (dark) of the color of the lipsticks also has higher lead content than high reflective value (light). Thus, consumers should purchase crème-type and light-colored lipsticks to limit exposure to lead.

Keywords: *lead content, lipstick, type of lipstick*

I. INTRODUCTION

Women are generally beautiful inside and out. But most women feel more beautiful and confident when they put on their lipstick. It enhances their beauty so they say. However, would it also be possible that this small tube of color could somewhat be detrimental to women's health?

The Food and Drug Administration on 2012, conducted a study that tested 400 lipstick tubes for lead content. The twenty lead-iest lip colors were as listed, according to nifty graph Mother Jones put together. The lipstick with the most lead, Brand A "PP" had 7.19 parts per millions of lead. There is no safe threshold for lead exposure. Any detectible amount of lead is too much lead to be in a lipstick (Sauer, 2013). What is concerning aside from the fact that there is lead in lipsticks at all — is that the highest concentrations of lead appear in drugstore brands. This list is dominated by big name brands of the drugstore cosmetics aisle. Women's risk from exposure to toxic chemicals shouldn't rise as the cost of makeup falls — just because you do not shop department-store brands shouldn't mean you have to take your chances with lead and carcinogenic metals like cadmium.

In a similar study, teenage girls were asked to give their lipsticks and lip glosses to be tested for toxic metal content including lead and cadmium. The researchers found out that a significant amount of metal content are ingested by women who apply lipstick twice a day or more. Although 20% of the daily amount is considered safe in drinking water – aluminum, cadmium, chromium and manganese. As for women who slathered lipsticks numerous times a day, they either meet or surpassed the daily recommended exposure to chromium, aluminum and manganese, depending on the lipstick they were using. Lead was detected in 75% of the samples in the study. It is a known fact that lead is one metal that human should entirely avoid (Serverns, 2013). Elevated levels of lead exposure can lead to serious and severe health repercussions such as miscarriages for pregnant women, or seizures in general. For

children, the consequences are as equally fatal—high lead exposure may lead to permanent brain damage and in extreme cases, death (Drum & Jan, 2013). Two recent studies have shown that lead and other dangerous metals are present in cosmetics especially lip products.

With these detrimental effects of lead in cosmetics, determining the safety level for lead content remains a stumbling block. In the most recent analysis of the FDA, they found out that the highest lead concentration—7.19 ppm—is in Brand A's "PP" lipstick. But the average lead contamination in the 400 lipsticks tested last year was 1.11 ppm, very close to the average from the agency's 2008 analysis. Since this is the recent case, the consumer should limit their exposure to lead by just avoiding or not buying the brands of lipsticks with the characteristic that influence high lead content.

This study wants to analyze the characteristic of the lipsticks that influence high lead content value of the top 100 lead-filled lipstick brands through data mining using multivariate cluster analysis. These characteristics are the type of lipstick — Matte or Crème and the reflective value (lightness or darkness) of the lipstick color.

II. CONCEPTUAL FRAMEWORK

Everyday, women much like breathing apply lipstick without second thoughts. What is unknown to them is that these lipsticks may contain lead. This notorious metal is a neurotoxin that can cause learning, language and behavioral problems even at small doses. If it is indeed damaging to one's health, what is lead doing in the lipstick industry? Although not all lipstick brands have lead content on their products, a number of recent studies have shown that the particular metal is more prevalent than previously thought.

In a study by Campaign for Safe Cosmetics (2007), they detected lead in 61% of the 33 lipstick samples. Using parts per million (ppm) as measurement of lead in the environment, the study indicated the lead content levels range from 0.03 ppm to 0.65 ppm. The FDA does not consider the lead levels found in lipsticks to be a safety issue as opposed to the opinions of medical experts who articulates that there is no safe level of lead in the blood.

Although no lipstick company lists lead as part of its product ingredient, the recent studies cannot be totally ignored. No matter how minute the amount of lead in such raises concerns on the health of its users.

Due to public demand as well as the cosmetic industry, the FDA conducted its own testing research on 2011. The findings were beyond belief. In all 400 lipsticks tested, the lead content range from 0.9 to 3.06 ppm. These results are four times higher than that observed in the study conducted by Campaign for Safe Cosmetics.

Apparently, lead is not the only toxic metal that women might be exposed to. In a recent study conducted by the University of California, they detected nine toxic heavy metals, including Chromium (Cr), Cadmium (Ca), Manganese (Mn), Aluminium (Al) and Lead (Pb).

The Food and Drug Administration said, "We have assessed the potential for harm to consumers from use of lipstick containing lead at the levels found in both rounds of testing. Lipstick, as a product intended for topical use with limited absorption, is ingested only in very small quantities. We do not consider the lead levels we found in the lipsticks to be a safety concern."

Concurred by the cosmetic industry, the revealed trace amount of heavy metals is not seen as harmful. Thus, lead content and other toxic metal content in cosmetic products are not an issue.

However, the FDA noted, "Although we do not believe that the lead content found in our recent lipstick analyses poses a safety concern, we are evaluating whether there may be a need to recommend an upper limit for lead in lipstick in order to further protect the health and welfare of consumers." The FDA and the cosmetics industry may have been ignoring cumulative exposure and potential long-term adverse effects.

While it is true that a single application of lip products may not be harmful, it is undeniable that long time exposure to lead and other toxic metals have adverse effects. The good news is that not all lipsticks contain detectable levels of lead or other heavy metals. Moreover, cost does not seem to be a factor; a cheap or expensive lipstick is not the determinant of how much lead is present.

According to a study of the University of

California, it would only become a problem if women reapplied lipstick more than once throughout the day. Reapplication of lipstick implies that many women could be rubbing up to 87 milligrams of the product on their lips daily. Once is enough, twice is something to be worried about, and yet many women reapply as many as 14 times a day—enough to warrant health concerns. Women do not just apply lipstick several hours per day but are continually doing this their entire lifetime, which means that exposure to lead and other heavy metals adds up and can potentially affect their health in the long run.

One challenge for people who wants to avoid exposure is that none of the metals, with the exception of aluminum, are deliberately added to lipsticks and lip glosses. The metals are contaminants that are present in the pigments and base materials used to make the products. Since metals are not part of the ingredients, cosmetics companies are not required to list these metals on the products' ingredient labels.

The law regulating cosmetics was passed in Congress on 1938 but it has never been updated. The FDA neither possess legal authority to make sure products are safe before they are sold nor empowered to pull dangerous products from store shelves. It is the Wild West for cosmetics companies, which have very few rules restricting chemical ingredients used in everything from shampoos to lotions to lipsticks.

As the contamination of lip products with heavy metals makes it clear, allowing the industry to police itself is not the best idea. We need the FDA to be empowered by Congress and to take action so women will not face any health risks when they put on makeup. Cosmetics companies should be required to adhere to a standard for best manufacturing processes to limit metal contamination (FDA, 2014).

Consumers must do take precautionary measures to protect themselves from lip products containing heavy metals. First, be aware. Always read the ingredient list and health articles that would educate people on what are the safety products out in the market. Second, limit the usage and if possible remove it from your lifestyle. Third, do not expose your children to these products as they are the most vulnerable.

Of course, the safest course of action is to start using less lipstick. Women who reapply lipstick constantly throughout the day should start curbing the frequency with which they do it. More importantly, children must be kept away from these harmful chemicals at all costs, as they are particularly vulnerable to these substances. Thus, let us get to work to make sure that by the time they grow up, we have already solved the problem of toxic chemicals in cosmetics.

The concentration of lead in the cosmetics under study was lower than that of FDA standards, and the cadmium content in the samples was relatively high. The continuous use of these cosmetics can increase the absorption of heavy metals especially Cd and Pb into the body when swallowing lipsticks or through dermal cosmetic absorption. The effects of heavy metals such as lead in cosmetics can be harmful. Therefore, effort must be made to inform the users and the general public especially pregnant women and children of the harmful consequences of cosmetics (Nourmoradi, Foroghi & Farhadkhhani, 2013).

Researchers from UC Berkeley recently conducted an investigation on popular lip brands scattered across drugstores and department stores. Their findings reveals samples with highly toxic chemical content, something that considerably raised red flags for health concerns. The journal Environmental Health Perspectives also pointed out that in spite of the beauty products not exceeding the standards for public health exposure, the problem lies in women who constantly reapply the product many times a day. It was also mentioned that the presence of the chemical chromium in lip products can be linked to the occurrence of stomach tumors. Other chemicals found in lipsticks which pose health problems to women are aluminum, cadmium, and manganese. Worse is the fact that some children play with makeup, and their high sensitivity to lead makes it a very bad idea to expose children to lipstick (Rasanayagam, 2014).

III. DESIGN AND METHODS

The research design of this study uses comparative design utilizing data mining methods specifically two-way Analysis of Variance in treating data. The data is gathered through

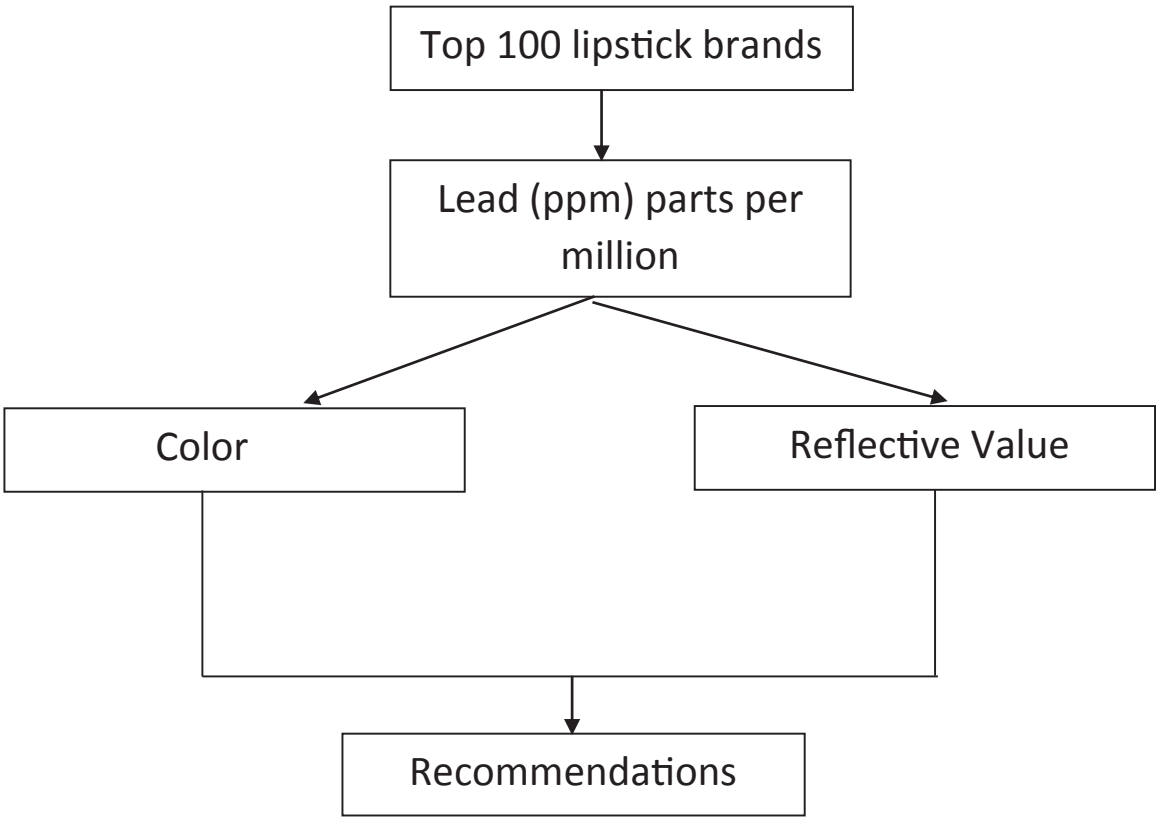


Figure 1
Schematic Diagram of the Conceptual framework

data mining from www.fda.gov/Cosmetics/ Products Ingredients. This data set is subjected to multivariate cluster analysis using hierarchical clustering algorithm. The data that was gathered online contain the following information: the lead content value (ppm), type of lipstick reflective value (pertaining if its crème or matte type); and color (either light or dark colored) of each lipstick brand.

IV. RESULTS AND DISCUSSIONS

This segment will discuss the results of the two-way ANOVA of the different lipstick brands which provide the lead content information and so with color of lipstick and its reflective value.

Below is a table presenting the frequency count of the lipsticks in terms of their color and reflective value properties:

Table 1
Between-Subjects Factors

		Value Label	N
Color	0	Dark	42
	1	Medium	49
	2	Light	9
Reflective Value	0	Matte	3
	1	Semi-Matte	65
	2	Creme	32

As seen in the table, among the 100 lipsticks, most of them were either dark (*f*=42) or medium-colored (*f*=49), and in terms of reflective value, majority of them were semi-matte (*f*=65).

The table below shows the results for the two-way Analysis of Variance conducted.

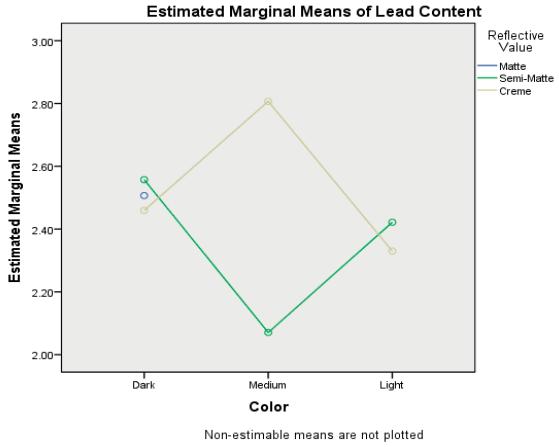
Table 2
Tests of Between-Subjects Effects

Source	Type III SS	df	MS	F	*p*-value
Corrected Model	6.707a	6	1.118	1.011	.423
Intercept	182.980	1	182.980	165.509	.000
Color	.161	2	.080	.073	.930
RefValue	.421	2	.210	.190	.827
Color * RefValue	3.614	2	1.807	1.634	.201
Error	102.817	93	1.106		
Total	677.107	100			
Corrected Total	109.524	99			

a. R Squared = .061 (Adjusted R Squared = .001)
Legend:
SS - Sum of Squares
MS- Mean Squares

As seen in the table above, there is no significant difference in the lead content of the lipsticks based on their color (F=.073, p=.93), reflective value (F=.19, p=.827), or an interaction between both independent variables (F=1.634, p=.201).

The graph on the next page also shows the estimated marginal means of the variables and their interaction.



The graph depicts that there is no significant pattern in the lead content in terms of whether the lipsticks were of dark, medium, or light color, and whether they had matte, semi-matte, or crème reflective values.

In other words, as of this study we cannot make significant conclusions about whether a lipstick's lead content can depend on its color and reflective value.

V. CONCLUSION

After data collection and analysis, the two-way ANOVA revealed that there was no significant difference in lead ppm (parts per million) between lipsticks of different colors and lipsticks of different reflective values. Perhaps considerations have to be taken into account about the chemical makeup of lipstick and how they are formulated. Future researchers may consider taking other factors into account when trying to determine how to identify the lead content in a lipstick based on its aesthetic aspects.

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